# Fuel Efficient Tire Program

Transportation Policy Committee Workshop

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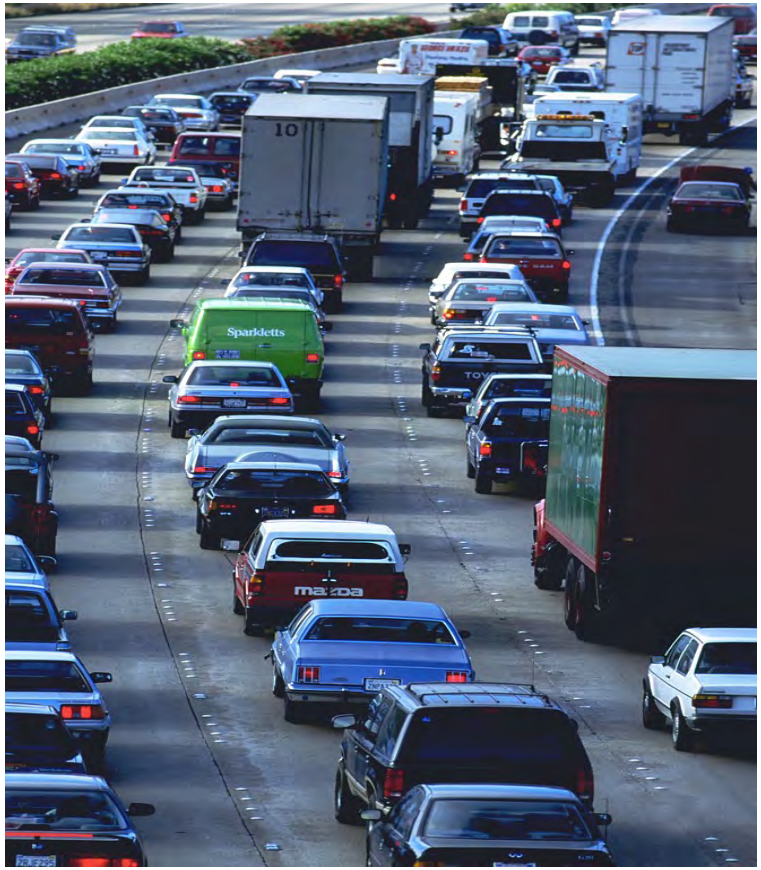
California Energy Commission

# Fuel Efficient Tire Program




- 27 million passenger vehicles and light trucks in California
- 6.75 million replace tires each year
- Fuel Efficient Tires??

# Fuel Efficient Tire Program

- **CEC SB 1170 Report (2003):**

  "Lack of consumer information hinders widespread use of fuel efficient tires."

- **TRB Report (2006):**

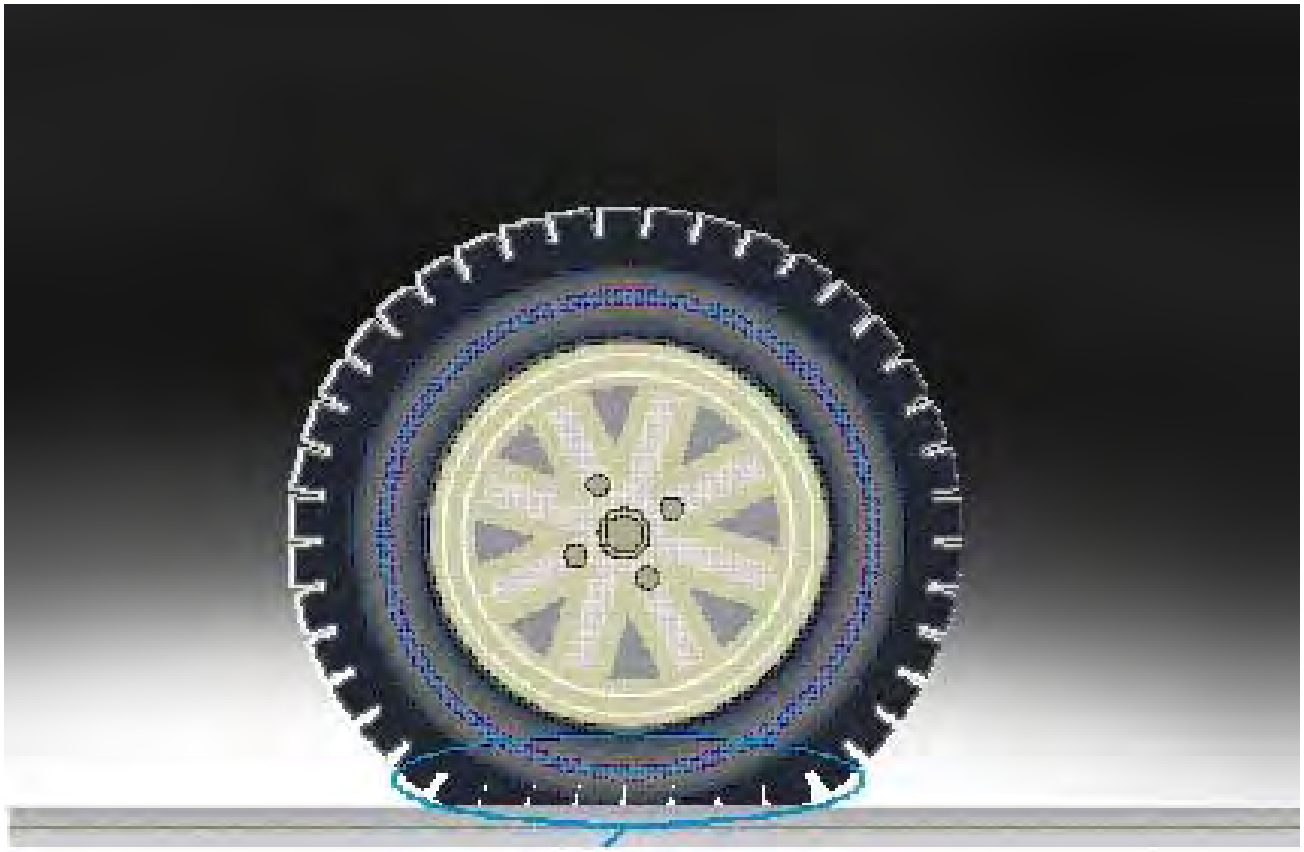
  "Consumers have little, if any, practical way of assessing how tire choices can effect vehicle economy."

# Fuel Efficient Tire Program

- **AB 844 Directive:**

Develop and adopt a system that will enable consumers to make more informed decisions about fuel efficient tires.

# Fuel Efficient Tire Program

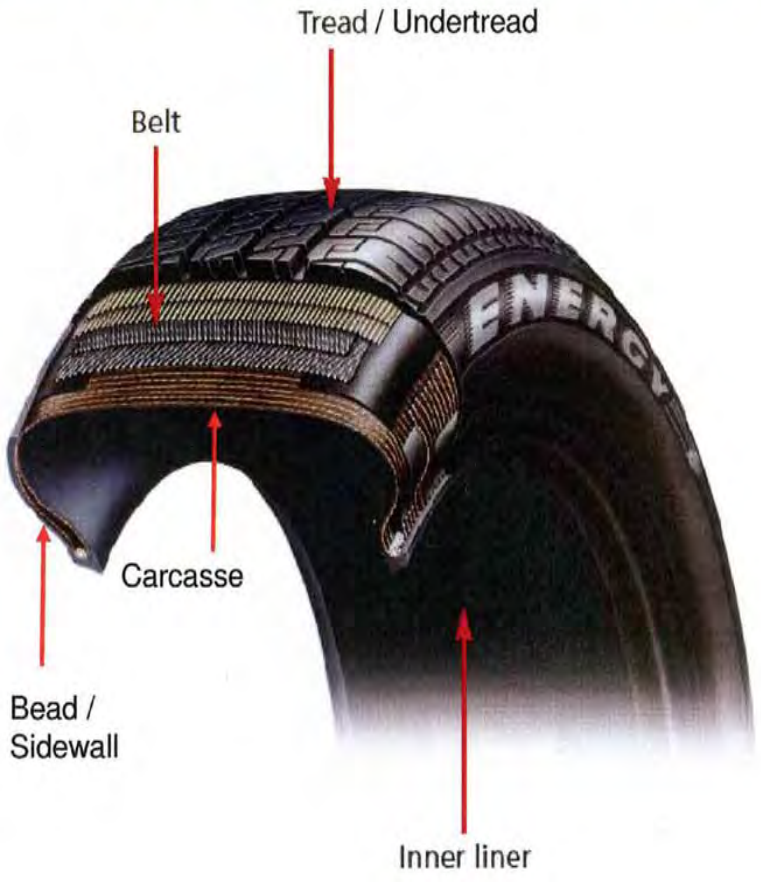


**Rolling Resistance = Energy loss due to deformation**

# Fuel Efficient Tire Program

Classical distribution of energy dissipation / rolling resistance within the tyre

| | |
|---|---|
| Tread / Undertread : | 50 % |
| Belt : | 20 % |
| Bead / Sidewall : | 20 % |
| Inner liner : | 5 % |
| Carcasse : | 5 % |



# Fuel Efficient Tire Program

## Rolling Resistance Testing

# Fuel Efficient Tire Program

## Rolling Resistance Test Protocols:

SAE (USA)

- J2452 Coastdown
- J1269 Multi-point
- J1269 Single point

ISO (Europe/Global)

- 18164 Multi-point
- 28580 Single point, with machine alignment

# Fuel Efficient Tire Program

## NHTSA Test Protocol Evaluation:

- Five Test Protocols
- Two Machines at Two Different Labs
- Twenty-Five Tire Models
  600 total tires

# Fuel Efficient Tire Program

## NHTSA Test Protocol Conclusions:

- All protocols produce data with low variation
- All protocols rank tires into the same groups
- Data from any protocol can be correlated to data from any other protocol
- Single-point protocol is most efficient
- Any protocol selected will need a procedure to account for machine-to-machine differences

# Fuel Efficient Tire Program

## AB844 Directive:

Adopt Test Procedure

## CEC Staff Proposal:

ISO 28580 Test Protocol

- Individual machine accuracy:

  ≤0.075 sigma ≈ 1 - 2%

- Machine to machine accuracy:

  ± 2%

# Fuel Efficient Tire Program

**AB 844 Scope:**

Tires that are designed to replace a tire sold with a new passenger car or light-duty truck.

# Fuel Efficient Tire Program

## Industry Terminology for “On Road” Tires:

- Passenger Tires
- Light Truck “LT” Tires
- Medium Duty Truck Tires
- Heavy Duty Truck/Bus Tires

# Fuel Efficient Tire Program

## Medium Duty Truck Tires

## Heavy Duty Truck Tires

# Fuel Efficient Tire Program

## Passenger Tires

### (Automobiles, Compact/std SUVs & Pickups)

# Fuel Efficient Tire Program

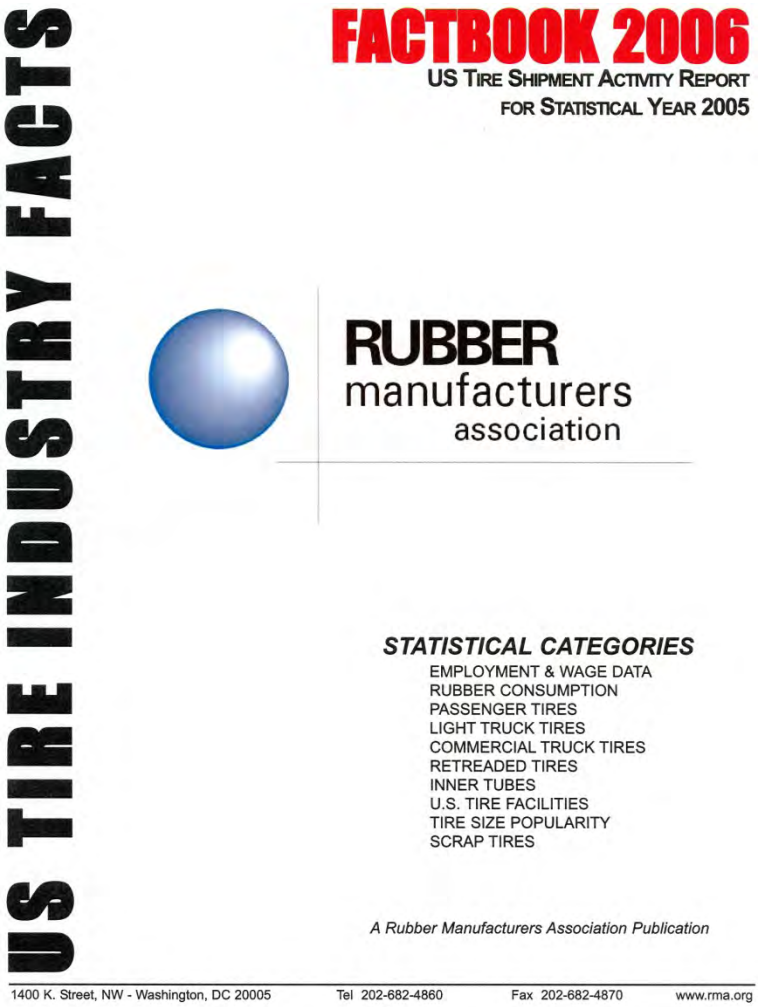
## Light Truck “LT” Tires
### (Large Pickups & SUVs)

# Fuel Efficient Tire Program

## Large Pickups & SUVs Using LT Tires:

- Hummer H2
- Chevrolet Blazer, Express Van, Sportvan, Suburban, Tahoe, Van, C/K 1500, 2500, and 3500 Pickup
- Dodge Caravan, Dakota Pickup, Ram 1500, 2500, and 3500 Pickup
- Ford Club & Super Wagon, Econoline Van, Excursion, F150, F250, and F350 Pickup, Ranger
- GMC C/K 1500, 2500, and 3500 Pickup, Rally, Savana Van, Suburban, Vandura, Yukon
- Jeep Wrangler
- Mitsubishi Montero
- Nissan Pathfinder & Pickup
- Toyota 4Runner

# Fuel Efficient Tire Program

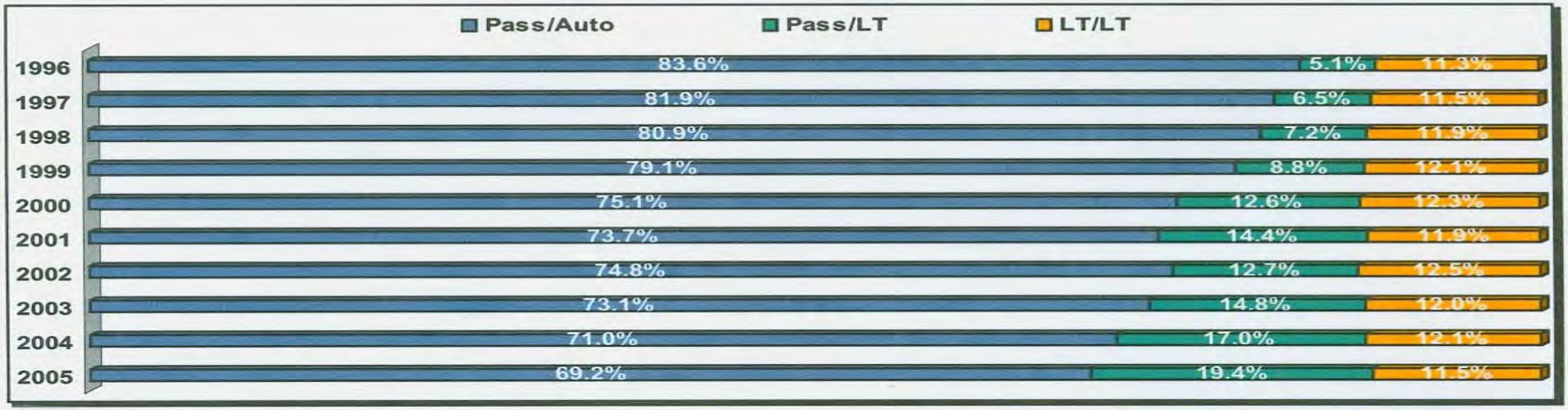



"For RMA purposes light truck tires are defined as tires with an "LT" prefix or suffix in the size designation"

# Fuel Efficient Tire Program

## RMA Factbook 2006

### TIRES USED FOR CONSUMER LIGHT VEHICLES
### SHIPMENTS: REPLACEMENT MARKET (RMA ONLY)




| Year | Passenger tires Used on Automobiles | Passenger tires Used on Consumer Light Trucks | Light Truck tires Used on Consumer Light Trucks | All Tires Used on Consumer Light Vehicles |
|---|---|---|---|---|
| 1996 | 83.6% | 5.1% | 11.3% | 100% |
| 1997 | 81.9% | 6.5% | 11.5% | 100% |
| 1998 | 80.9% | 7.2% | 11.9% | 100% |
| 1999 | 79.1% | 8.8% | 12.1% | 100% |
| 2000 | 75.1% | 12.6% | 12.3% | 100% |
| 2001 | 73.7% | 14.4% | 11.9% | 100% |
| 2002 | 74.8% | 12.7% | 12.5% | 100% |
| 2003 | 73.1% | 14.8% | 12.0% | 100% |
| 2004 | 71.0% | 17.0% | 12.1% | 100% |
| **2005** | **69.2%** | **19.4%** | **11.5%** | **100%** |

# Fuel Efficient Tire Program

**California Consumer Vehicles (2006):**

- 23.5 million use Passenger Tires
- 3.5 million use Light Truck “LT” Tires

# Fuel Efficient Tire Program

**AB 844 Scope:**

Tires that are designed to replace a tire sold with a new passenger car or light-duty truck.

**CEC Staff Proposal:**

All Passenger & LT tires available for sale in California are in the scope.

# Fuel Efficient Tire Program

- **AB 844 Directive:**

Develop a database of the energy efficiency of a representative sample of replacement tires sold in the state.

# Fuel Efficient Tire Program

## Databases in the Public Domain

**ECOS, 2002**

34 tires: 34 manufacturers/brands, 4 sizes

**TRB, 2006 (Mostly from RMA)**

162 tires: 57 manufacturers/brands, 70 sizes

**CEC 2005 - 07**

140 tires: 1 manufacturer/model, 28 sizes, 5 samples

200 tires: 7 manufacturers/brands, 10 sizes,10 samples, 2 groups

605 tires: 121 manufacturers/brands, 2 sizes, 5 samples

**NHTSA 2007 - 08**

600 tires: 11 manufacturers/brands, 7 sizes

**RMA, April 22, 2009**

1007 tires: includes CEC, TRB & ECOS

# Fuel Efficient Tire Program

**RMA/Environ Report, April 22, 2009:**

"Tire shipment data indicate that the size and speed rating categories of the tires listed in the comprehensive data set represent nearly 90 percent of the replacement tires sold in the domestic tire market in 2006."

# Fuel Efficient Tire Program
# CEC Database

## P195/65R15

Honda Accord, Toyota Corolla
Dodge Status, Nissan Altima
Pontiac Sunfire, Saturn L

- Sales over 6 million/yr, top five of all sizes
- CEC tested 76 Make/Model Tires

## P265/70R17

Chevy Silverado & Avalanche PU
Cadillac Escalade, GMC PU
Dodge Ram PU, Ford F150 PU
Ford Expedition, GMC Yukon

- Sales over 3.5 million/yr, top fifteen of all sizes
- CEC Tested 45 Make/Model Tires

# Fuel Efficient Tire Program

- **AB 844 Directive:**

Develop a rating system for the energy efficiency of replacement tires that will enable consumers to make informed decisions when purchasing tires.

# Fuel Efficient Tire Program

## Federal Uniform Tire Quality Grading System (UTQG)

### Traction Grade
**AA, A, B, C**

Wet skid resistance
(traction coefficient)

| | Asphalt | Concrete |
|---|---|---|
| AA | >0.54 | >0.38 |
| A | >0.47 | >0.35 |
| B | >0.38 | >0.26 |
| C | <0.38 | <0.26 |

### Temperature Grade
**A, B, C**

Ability to Operate at Speed
(MPH)

| | |
|---|---|
| A | >115 |
| B | 100 - 115 |
| C | 85 - 100 |

# Fuel Efficient Tire Program

**Federal Uniform Tire Quality Grading System (UTQG)**

**Treadwear Grade**

**20 – 900**

Projected wear rate expressed as a percentage of the nominal treadwear value of a NHTSA Standardized Course Monitoring Tire (= 100)

* Valid only for comparisons within a manufacturer's product line.

# Fuel Efficient Tire Program

## Existing Rating System Shortcomings

- Grades Not Easily Understood:

  Indexes (A, B, C, etc.) require detailed knowledge

- Grades “as Reported” are Not Reliable:

  No actual tire tests required

  Grade is manufacturer’s “self certification” claim

  Manufacturer may claim a lower grade

# Fuel Efficient Tire Program

## Tire Store Observations & Interviews

- Consumer Purchases:
  - “Need Tires Now”
  - Few “Planned”
- Dealer Perspective of Consumers:
  - 90% know nothing about tires
  - 10% do research

# Fuel Efficient Tire Program

## Tire Dealer & Consumer Roundtable

- Tire Dealers:

  Keep it Simple

- Consumer Representative:

  Presentation to consumer has to be intuitive

# Fuel Efficient Tire Program

## CEC Staff Proposed Rating System "Fuel Efficient Tire"

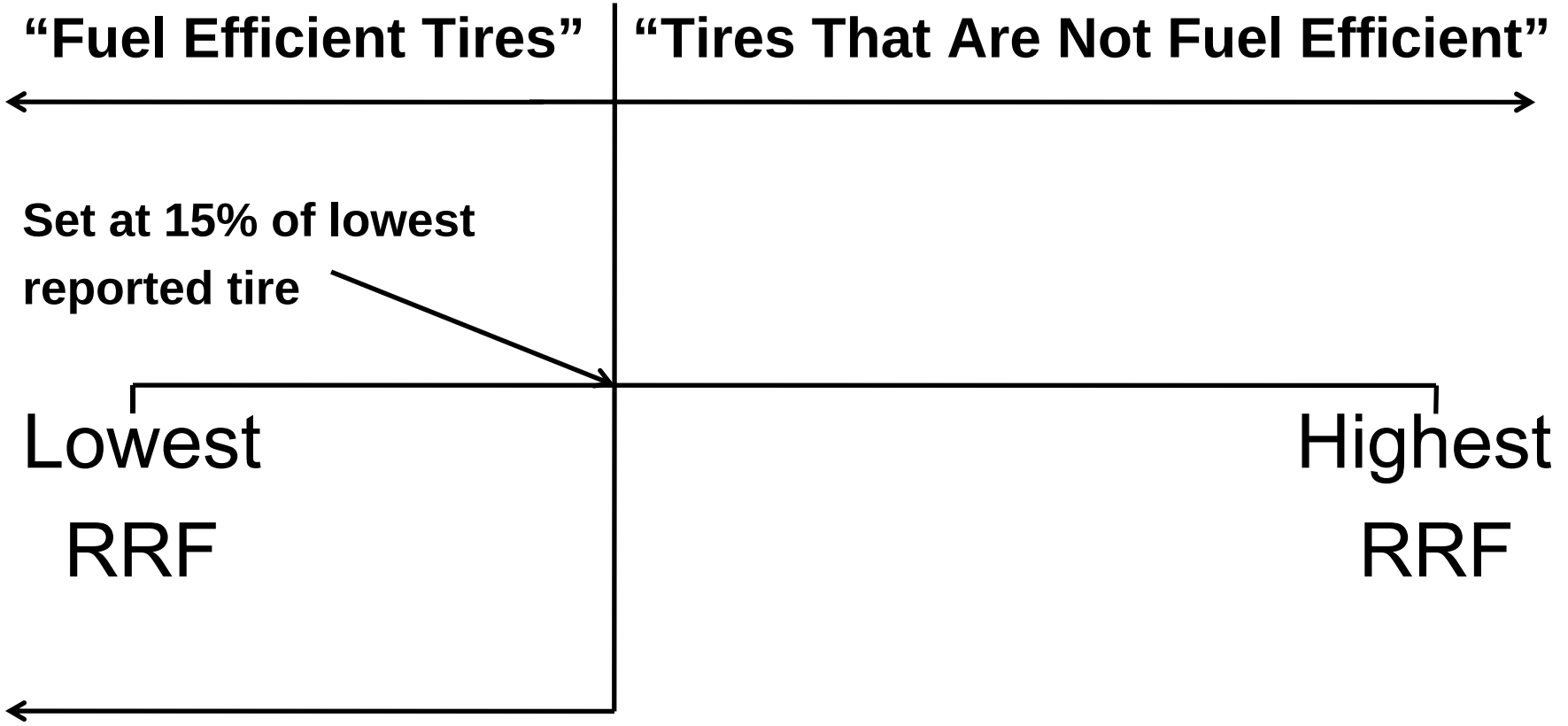
- Intuitive, ease of use and understanding

  "Do You Have Any Fuel Efficient Tires?"

  "Would You be Interested in a Fuel Efficient Tire?"
- Fits majority of purchases/sales
- Potential EPA "Energy Star", "Smartway"

# Fuel Efficient Tire Program

## Ranking by Tire Size & Load Index



# Fuel Efficient Tire Program

## Driven by “Best In Class”:

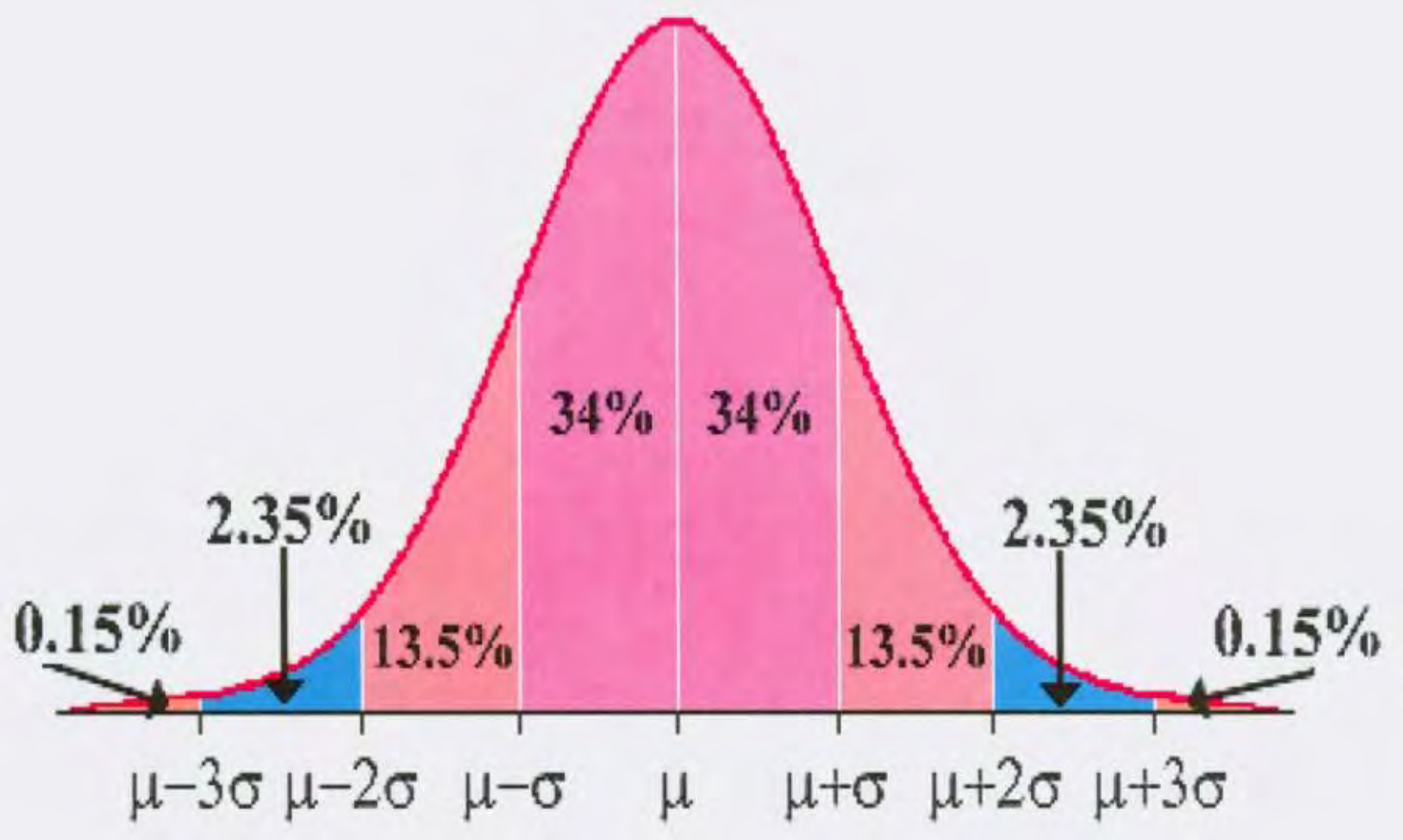
- Reward the best
- Stimulate competition

## Basis for 15% cutoff:

- Recognize the highest performers
- Ensure multiple manufacturers qualify
- Analogous to successful “Energy Star”

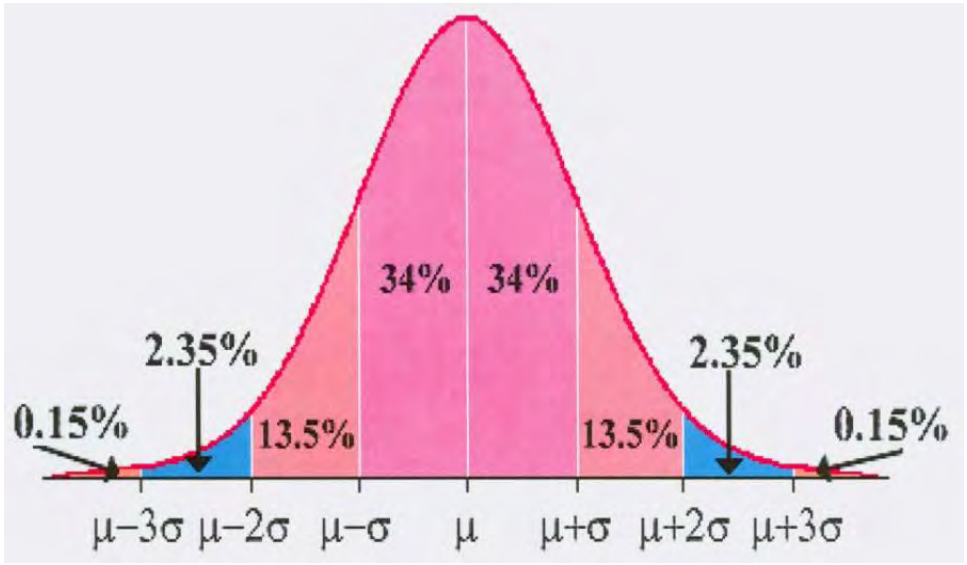
# Fuel Efficient Tire Program

## Normal Distribution and Std Deviation

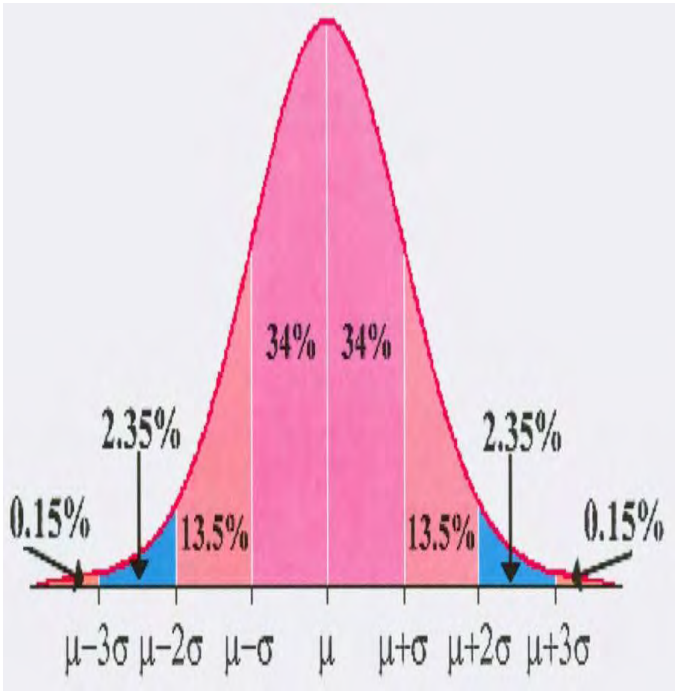


# Fuel Efficient Tire Program

## Wide Data Range




## Narrow Data Range



# Fuel Efficient Tire Program

## Declared Fuel Efficiency Rating Value:

"Mean (average) plus 2 standard deviations from tests of three tires"

- Handles product variations
- Encourages high quality control

# Fuel Efficient Tire Program

## Actual Tests & Comprehensive Data

- The “foundation” of the rating system
- Accurate, consistent, reliable, complete
- Available to everyone
- Addresses the need of product researchers
- Empowers analysis and creative use
- Enables competition

# Fuel Efficient Tire Program

## CEC Staff Proposed Manufacturer Reporting Requirements

### Existing From Tires

Brand Name
Model Name
OEM Fitment
SKU Number
DOT Number
Tire Size
Special Features
TW Ply&Material
Sidewall Lettering
Weight
Overall Diameter
Tread Depth
Max Load
Max Pressure
Load Index
Load Range
Speed Rating
UTQG Temp
UTQG Traction
UTQG Treadwear

### From Tire Tests

Test Machine Identifier
Test Date
Test Method
Test Load
Test Inflation Pressure
Test Speed
Rolling Resistance Force (RRF)
RR Coefficient (RRC)
Declared Rating Value (RRF)

# Fuel Efficient Tire Program

## Number of Tire SKUs Sold in USA

| | Passenger Tires | Light Truck Tires | TOTAL |
|---|---|---|---|
| Primary Brands: # Tire SKUs | 13,950 | 2,354 | 16,304 |
| Other Brands: # Tire SKUs | 6,758 | 942 | 7,700 |
| **Total SKUs** | **20,708** | **3,296** | **24,004** |

# Fuel Efficient Tire Program

| | Passenger SKUs | Light Truck SKUs |
|---|---|---|
| Goodyear | 2,042 | 345 |
| Michelin | 1,917 | 279 |
| Bridgestone | 1,844 | 263 |
| Continental | 1,391 | 72 |
| Cooper | 2,440 | 975 |
| Yokohama | 1,619 | 204 |
| Hankook | 1,353 | 208 |
| Toyo | 903 | 157 |
| Kumho | 1,358 | 274 |
| Sumitomo | 598 | 30 |
| Pirelli | 891 | 34 |
| Tier 3 | 4,352 | 455 |

# Fuel Efficient Tire Program

## Test Logistics

- Number of Test Machines
- Availability of Machines
- Length of Workday (8 – 24 Hours)
- Workdays/Year (250 – 350 Days)

# Fuel Efficient Tire Program

| | Machines | Test Years |
|---|---|---|
| Goodyear | 4 | 0.6 |
| Michelin | 4 | 0.6 |
| Bridgestone | 4 | 0.5 |
| Continental | 4 | 0.4 |
| Cooper | 2 | 1.9 |
| Yokohama | 2 | 0.9 |
| Hankook | 2 | 0.8 |
| Toyo | 2 | 0.5 |
| Kumho | 2 | 0.8 |
| Sumitomo | 2 | 0.3 |
| Pirelli | 2 | 0.4 |

**Assumptions:**

50% machine availability

24 hr workdays

350 days/year

**Options:**

Independent Test Labs

Add more machines

# Fuel Efficient Tire Program

## Manufacturer Reporting Deadline

## CEC Staff Proposal:

July 1, 2011

# Fuel Efficient Tire Program

| | 2008 N.A. Sales | Test Costs | % of Sales |
|---|---|---|---|
| Goodyear | $7,900,000,000 | $2,547,750 | 0.03 |
| Michelin | $7,500,000,000 | $2,339,280 | 0.03 |
| Bridgestone | $7,000,000,000 | $2,243,910 | 0.03 |
| Continental | $2,150,000,000 | $1,544,790 | 0.07 |
| Cooper | $2,100,000,000 | $3,702,750 | 0.18 |
| Yokohama | $900,000,000 | $1,938,630 | 0.21 |
| Hankook | $750,000,000 | $1,664,010 | 0.22 |
| Toyo | $650,000,000 | $1,131,840 | 0.17 |
| Kumho | $550,000,000 | $1,746,480 | 0.32 |
| Sumitomo | $500,000,000 | $663,000 | 0.13 |
| Pirelli | $475,000,000 | $975,330 | 0.21 |
| Tier 3 | | $5,101,960 | |

# Fuel Efficient Tire Program

| | Test Costs | Per P Tire * | Per LT Tire* |
|---|---|---|---|
| Goodyear | $2,547,750 | $0.06 | $0.08 |
| Michelin | $2,339,280 | $0.06 | $0.05 |
| Bridgestone | $2,243,910 | $0.05 | $0.06 |
| Continental | $1,544,790 | $0.17 | $0.04 |
| Cooper | $3,702,750 | $0.13 | $0.23 |
| Yokohama | $1,938,630 | $0.22 | $0.14 |
| Hankook | $1,664,010 | $0.17 | $0.20 |
| Toyo | $1,131,840 | $0.17 | $0.16 |
| Kumho | $1,746,480 | $0.27 | $0.57 |
| Sumitomo | $663,000 | $0.14 | $0.65 |
| Pirelli | $975,330 | $0.40 | $0.10 |

*Based on 2007 Annual Shipments

# Fuel Efficient Tire Program

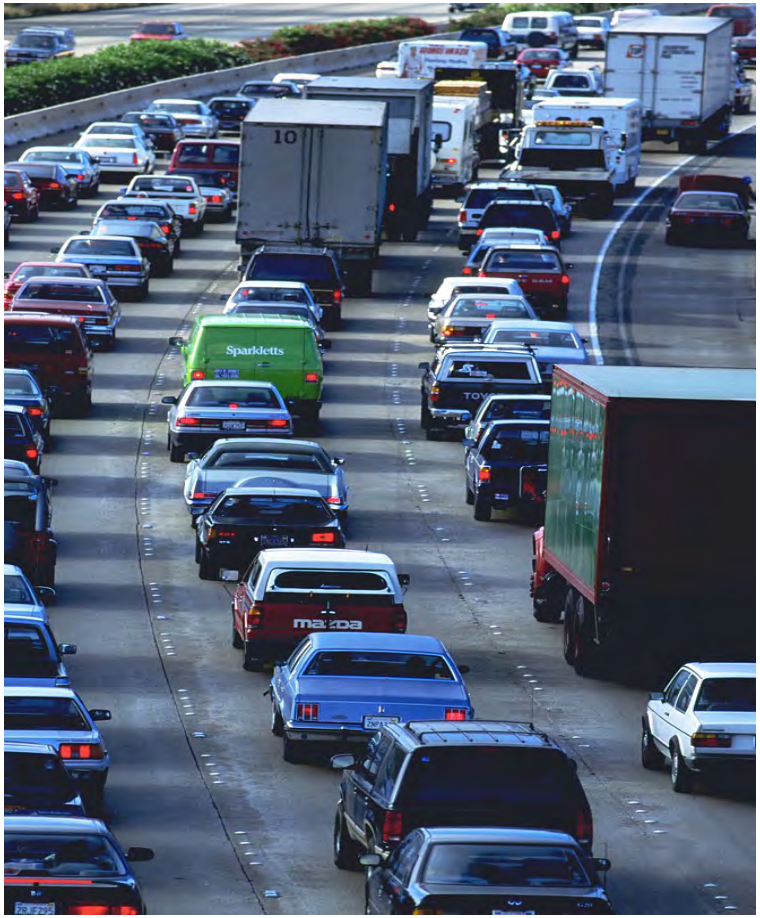
- 10% change in rolling resistance improves fuel efficiency up to 2%

# Fuel Efficient Tire Program

## California Consumer Vehicle Fleet

| | Annual Miles Traveled | Baseline Miles/gallon | FET Miles/gallon | Fuel Cost Baseline | Fuel Cost FET | Annual Fuel Cost Savings |
|---|---|---|---|---|---|---|
| CAR-SUBCOMPACT | 11,247 | 28.90 | 29.48 | $1,168 | $1,145 | $22.89 |
| CAR-COMPACT | 11,241 | 24.46 | 24.95 | $1,379 | $1,352 | $27.03 |
| CAR-MIDSIZE | 11,589 | 22.10 | 22.54 | $1,573 | $1,542 | $30.85 |
| CAR-LARGE | 10,508 | 20.36 | 20.77 | $1,548 | $1,518 | $30.36 |
| CAR-SPORT | 10,286 | 22.15 | 22.59 | $1,393 | $1,366 | $27.32 |
| CROSS/UT-SMALL- CAR | 14,599 | 23.71 | 24.18 | $1,847 | $1,811 | $36.22 |
| CROSS/UT-SMALL- TRK | 13,093 | 20.87 | 21.29 | $1,882 | $1,845 | $36.90 |
| CROSS/UT-MIDSIZE | 14,281 | 19.60 | 19.99 | $2,186 | $2,143 | $42.86 |
| SPORT/UT-COMPACT | 11,430 | 17.12 | 17.46 | $2,003 | $1,964 | $39.27 |
| SPORT/UT-MIDSIZE | 12,684 | 14.93 | 15.23 | $2,549 | $2,499 | $49.97 |
| SPORT/UT-LARGE | 12,309 | 14.12 | 14.40 | $2,615 | $2,564 | $51.28 |
| SPORT/UT-8,501-10,000 | 12,309 | 13.60 | 13.87 | $2,715 | $2,662 | $53.24 |
| VAN-COMPACT | 11,813 | 19.49 | 19.88 | $1,818 | $1,783 | $35.65 |
| VAN-STD | 11,413 | 14.79 | 15.09 | $2,315 | $2,270 | $45.39 |
| VAN 8,501-10,000 | 14,488 | 12.00 | 12.24 | $3,622 | $3,551 | $71.02 |
| PICKUP-COMPACT | 10,871 | 20.52 | 20.93 | $1,589 | $1,558 | $31.16 |
| PICKUP-STD | 11,530 | 15.44 | 15.75 | $2,240 | $2,196 | $43.93 |
| PICKUP 8,501-10,000 | 14,488 | 12.00 | 12.24 | $3,622 | $3,551 | $71.02 |

# Fuel Efficient Tire Program




2% improvement in California fuel efficiency =

- 300 million gallons/year fuel savings
- $900 million/year fuel savings
- 3.3 MMT/year CO2 reduction

# Fuel Efficient Tire Program

## Gains per dollar

Boosting mpg won't be cheap. So which technologies give the best bang for the buck? Here is a ranking based on government data, computed to show how much each technology costs per 1% gain in fuel efficiency. The computations assume the technologies are applied to a vehicle with a V-6 engine and a 4-speed automatic transmission. These are only approximations; costs vary by the size of the vehicle and other factors.

| | COST PER VEHICLE* | MPG GAIN | COST PER 1% GAIN IN MPG** |
|---|---|---|---|
| Low rolling-resistance tires | $6 | 1-2% | **$3** |
| Low-friction lubricants | $3 | 0.5% | **$6** |
| Aggressive shift logic | $38 | 1-2% | **$19** |
| Cylinder deactivation | $203-$229 | 4.5-6% | **$38** |
| Reduced engine friction | $21/cylinder | 1-3% | **$42** |
| 6-speed automatic transmission*** | $161-$262 | 3-5% | **$52** |
| Engine accessory improvement | $124-$166 | 1-2% | **$83** |
| Electric power steering | $118-$197 | 1.5-2% | **$99** |
| Smaller displacement Engine+turbocharging | $120-$810 | 5-7.5% | **$108** |
| Stop-start | $1,800-$2,000 | 5-10% | **$200** |
| Gasoline direct injection | $122-$525 | 1-2% | **$263** |

*Unless otherwise noted

**Based on the highest cost and the largest potential percentage gain

***Combined cost and benefits of going from a 4-speed to a 5-speed and then from a 5-speed to a 6-speed

Source: National Highway Traffic Safety Administration, 2953 Analytics, *Automotive News*

# Fuel Efficient Tire Program

## Summary

- **Scope:** All Passenger & LT tires available for sale in California
- **Test Protocol:** ISO 28580
- **Rating System:** All tires of the same size & LI ranked by RRF, “Fuel Efficient Tire” within 15% of lowest RRF
- **Reporting Requirements:** RRF test results plus detailed tire information for every SKU

# Fuel Efficient Tire Program

## Prominent Features

- **<u>Full Disclosure and Transparency</u>**

  Foundation of the program & rating system

- **<u>Consumer & Dealer Friendly</u>**

  Simply ask for a “Fuel Efficient Tire”

- **<u>Foster Market Competition</u>**

  Encourage advancement of technology

# Fuel Efficient Tire Program

## Acknowledgements


- Smither's Scientific Services
- Dr. Alan Meier, LBL
- NHTSA
- Consumer Reports
- Tire Rack